Mitigation of atmospheric delay in InSAR for fair estimate of crustal deformation at Azumayama volcano

*阿部 華菜[1]、小川 佳子[1]、久田 泰広[1]、出村 裕英[1]、小澤 拓[2]、三浦 哲[3]、日下部 玲[1]、荒井 雄大[1]
*Kana Abe[1], Yoshiko Ogawa[1], Yasuhiro Hisada[1], Hirohide Demura[1], Taku Ozawa[2], Satoshi Miura[3]
, Akira Kusakabe[1], Takehiro Arai[1]

1. 公立大学法人会津大学、2. 防災科学技術研究所、3. 東北大学大学院理学研究科
1. The University of Aizu, 2. National Research Institute for Earth Science and Disaster Resilience, 3. Graduate School of Science, Tohoku University

Azumayama volcano is one of the five active volcanoes in Fukushima prefecture which is now issued volcanic alert level 2. Since 2014 winter, the volcano had/has been issued the level 1 and 2 repeatedly according to the situation. It is the most active volcano in the Fukushima pref. We have been working to clarify time-series of crustal deformation at Azumayama volcano.

Abe et al. [2017, JpGU] conducted InSAR (Interferometric Synthetic Aperture Radar) analysis using ALOS2 (Advanced Land Observing Satellite 2)/PALSAR2 (Phased Array L-band Synthetic Aperture Radar-2) data and estimated crustal deformation around Azumayama volcano . However, some of the results showed subsidence at the west of Azumayama which would be due to atmospheric delay and ionospheric delay.

In this study, we attempted to correct atmospheric delay and ionospheric delay in InSAR analysis using three numerical weather models: MSM (MesoScale Model), LFM (Local Forecast model) and WRF (Weather Research and Forecasting). WRF is created by using MSM data to improve resolution of time. Then we tried to estimate the amount of crustal deformation more precisely from 2014 fall to 2017 fall after applying atmospheric correction. Eight of the ALOS2/PALSAR2 data were used for the InSAR analysis. We evaluated the InSAR results after performing each atmospheric correction based on each numerical model and compare them quantitatively and select suitable weather model among the three.

Artifacts and false fringe in InSAR results seem to be reduced. Comparing InSAR analysis results with the value of GNSS (Global Navigation Satellite System) analysis at ground stations, correction by LFM and WRF showed similar trend better than that by MSM. Numerical weather models with higher resolutions seem effective in correcting atmospheric delay in InSAR. Uplift and subsidence at the Oana crater and subsidence in the western part of Azumayama were detected during 2014 fall - 2015 summer and 2015 summer - 2015 fall, respectively, which reflect actual deformation.

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